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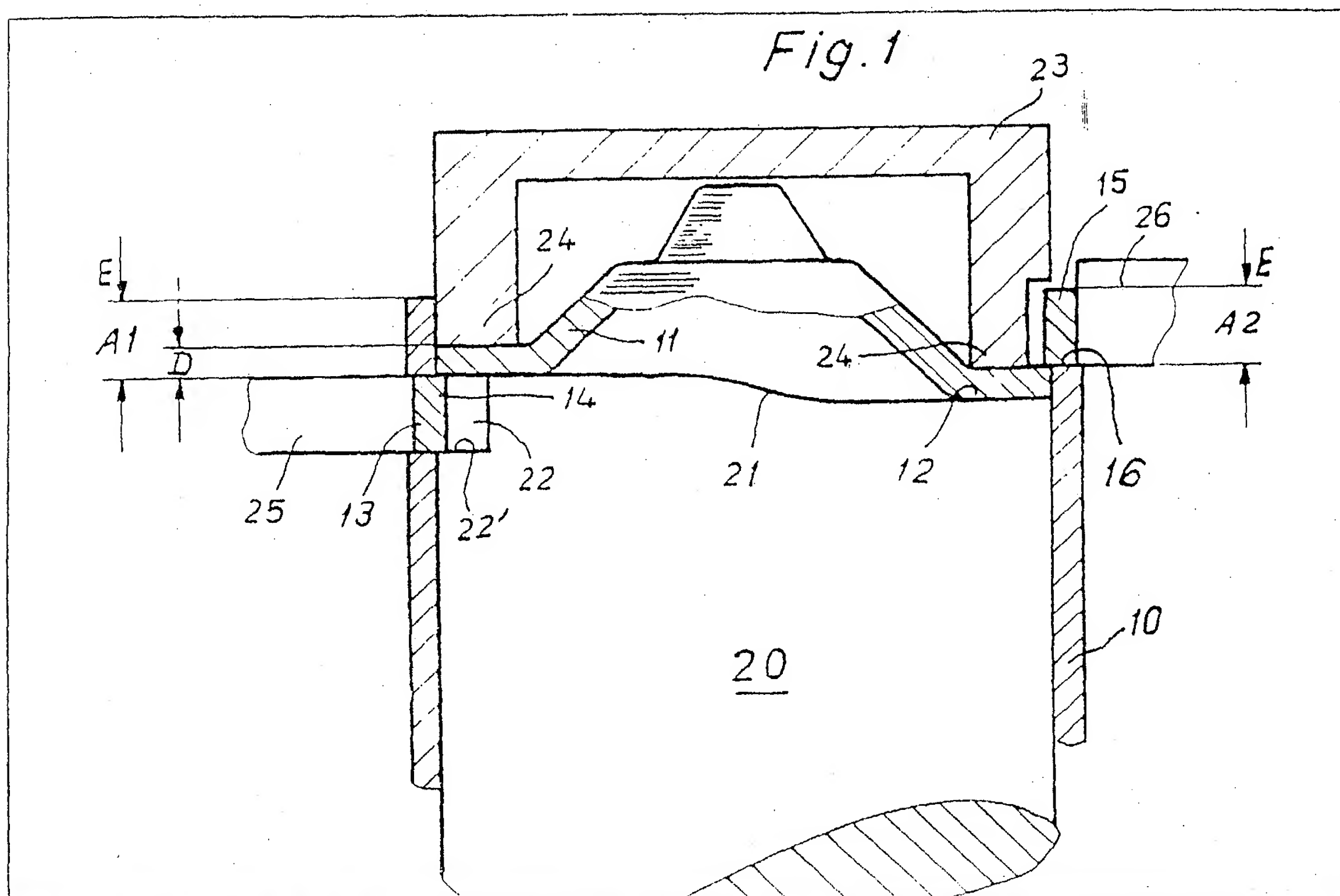
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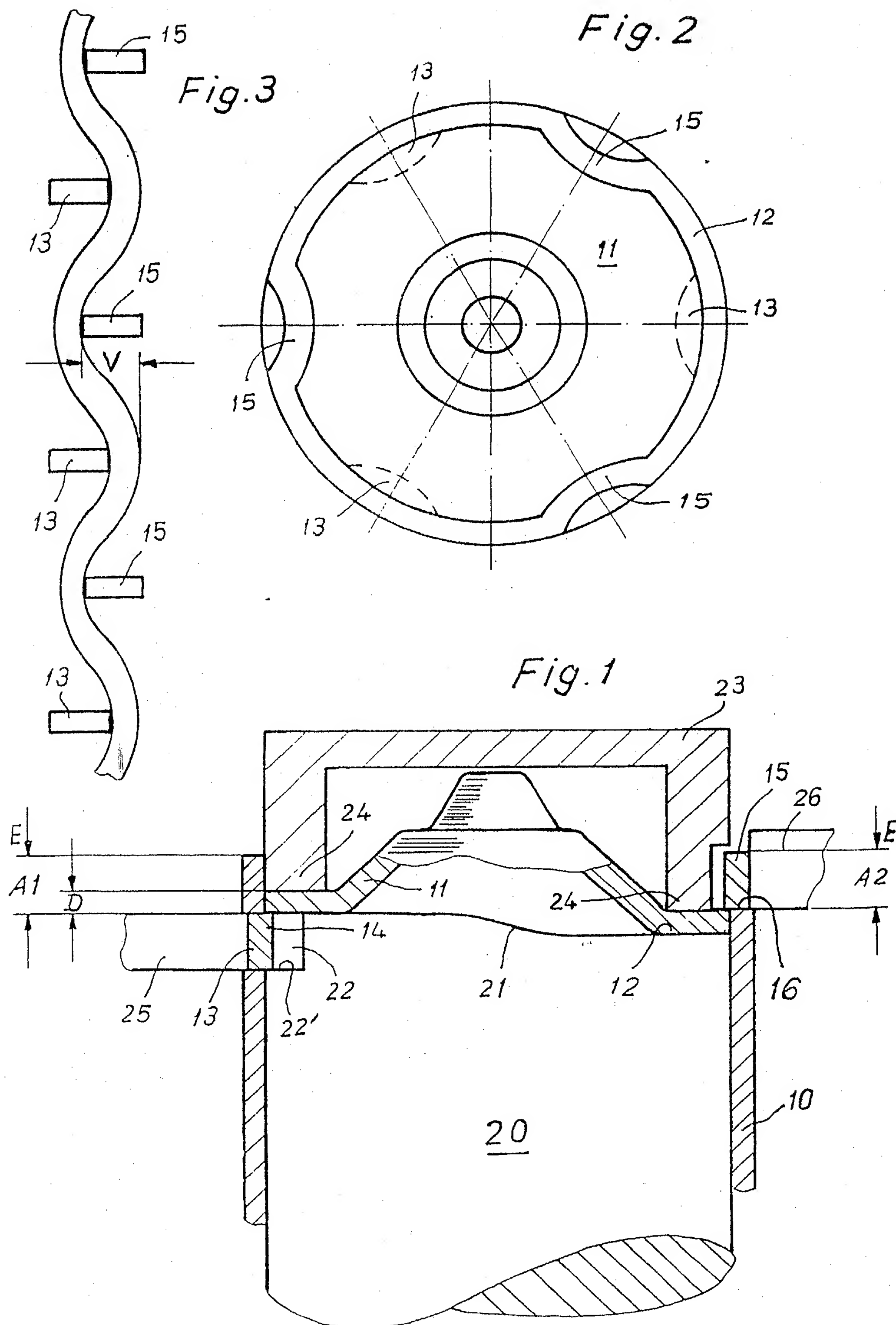
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(54) Housing for an electric motor or  
 generator and a method for its  
 production

(57) A housing for an electric motor or  
 generator comprises a shell (10) and an  
 end cap (11) located in the shell. The  
 cap (11) has a supporting rim (12) which  
 in an unstressed condition is planar.  
 Several supporting elements (13) and  
 also several holding elements (15) are  
 indented or cut in the shell (10) and  
 extend towards its interior. The holding  
 elements (15) are offset in a circum-  
 ferential direction relative to the sup-

porting elements (13) and the end cap  
 (11) rests against a supporting surface  
 (14) of the supporting elements (13)  
 with one side of its supporting rim (12)  
 and against the supporting surfaces  
 (16) of the holding elements (15) with  
 the opposite side of the supporting rim  
 (12). The axial spacing (A2) of the  
 supporting surface (16) of at least one  
 holding element (15) from a plane of  
 reference (E), is greater than the spac-  
 ing (A1) of the supporting surface (14)  
 of the supporting element (13) adjacent  
 to the holding element (15) minus the  
 thickness (D) of the cap from this plane  
 of reference (E). In this way the end cap  
 (11) is fixed under prestress between  
 these supporting elements (13) and the  
 holding elements (15). In the method of  
 manufacture of such a housing, the end  
 cap (11) is inserted into the shell (10) in  
 its intended position and the outer face  
 of the rim (12) of the end cap (11) serves  
 as a shearing edge for forming the  
 holding elements (15).





## SPECIFICATION

**Housing for an electric motor or generator and a method for its production**

5 This invention relates to a housing for an electric motor or generator of the type which comprises a shell and an end cap located in the shell and also to a method of manufacturing such a housing.

10 From the German specification OS No. 1,411,622 a motor housing is known, in which the end cap is located in a cylindric shell, rests upon supporting elements therein which are indented out of the shell and is secured by holding elements, which lap over  
15 the rim of the end cap and are then deformed towards the interior of the housing. Thus the end cap is secured at several points between the supporting elements and the holding elements arranged axially opposite the supporting elements. In practice it has  
20 been shown that this construction does not ensure securement of end cap in the shell properly without play because of the tolerances and the resilience of the holding elements at their bending point, which holding elements rest upon the cap only with point  
25 contact. This is a particular problem in the case of efficient motors in which the thickness of the shell is about 2.5 mm or more. In housings bent or rolled from a sheet metal blank it is especially disadvantageous that the end cap is inadequately secured on  
30 the shell, because the housing or the shell often cracks in the event of a heavy blow striking it. Also as far as moulded housings are concerned this kind of fastening of the cap is not always satisfactory, because the end cap could turn, when the force  
35 transmitted thereto is too great.

British patent specification No. 1,226,243 discloses a motor housing in which the supporting elements and the holding elements are offset relative to each other in the circumferential direction. In this case a  
40 web above a punched-out slot in the shell serves as a holding element, which web is substantially radially pressed inwardly. The upper edge of the slot and thus the supporting surface of the holding element is arranged at an axial spacing from the supporting  
45 surface of the supporting element, which corresponds to the thickness of the cap. This cap is therefore secured between the supporting elements and the holding elements without being stressed. It is true that the connection between end cap and  
50 shell is improved, because the holding elements do not just make point contact with the cap but have areas of contact. However this conception cannot be realised in the case of more efficient motors with a thicker shell, because it is not possible to make the  
55 slots in view of the risk of breaking the die in mass production. It should also be taken into consideration that the axial widths of these slots should, if possible, be smaller than the thickness of the cap, so that this slotted rim is covered and thus the housing  
60 is sealed.

The invention is based on the problem of improving the stability of the connection between the end cap and the shell of such a housing.

According to the invention there is provided a housing for an electric motor or generator comprising a shell and an end cap located in the shell with a supporting rim which in an unstressed condition is  
70 planar wherein several supporting elements and also several holding elements, are indented or cut in the shell and extend towards its interior which holding elements are offset in a circumferential direction relative to the supporting elements, and  
75 wherein the end cap rests against a supporting surface of the supporting elements with one side of its supporting rim and against the supporting surfaces of the holding elements with the opposite side of the supporting rim, characterised in that the axial  
80 spacing of the supporting surface of at least one holding element from a plane of reference, for example the front side of the shell, is greater than the spacing of the supporting surface of the supporting element adjacent to the holding element minus  
85 the thickness of the cap from this plane of reference such that the end cap is fixed under prestress between these supporting elements and the holding elements.

The invention is thereby based on the idea that a  
90 particularly solid bracing between the end cap and the shell is achieved, when this end cap is braced between the supporting elements and the holding elements in the axial direction. This is achieved according to the invention in that the supporting  
95 elements and the holding elements are axially offset by an amount which is smaller than the thickness of the cap. The rim of the cap which is planar in the relaxed condition thus obtains a corrugated contour, whereby due to the elasticity of the end cap material  
100 forces are exerted onto the supporting elements and the holding elements, so that the shell and the end cap so-to-speak stick to each other in the area of these supporting elements and of the holding elements. Thus on the one hand a turning of the end  
105 cap relative to the shell is effectively prevented and on the other hand the risk is diminished that the shell cracks when it receives an impact. Thus a connection between end cap and shell has been created which is free from play and can endure heavy load.

110 The method according to the invention for the production of a housing of this kind is characterised in that the end cap is inserted into the shell in its intended position and the outer face of the rim of the end cap serves as a shearing edge for forming the  
115 holding element.

If especially in smaller housings a low prestress is satisfactory it can be sufficient to put the cap with its planar rim in relaxed condition upon the supporting elements, because when the holding elements are  
120 cut in, the rim of the cap is slightly displaced in the axial direction due to a certain wedge effect and thus prestressed.

In more efficient motors however the end cap of an especially preferred embodiment will be held  
125 prestressed in its final position in the shell by tools. Thus the prestress of the rim of the cap is exactly defined by the shape of the tool.

supporting elements. Thus the shell punched out of a blank can be directly bent or rolled around an arbor without any preparatory work, then the end cap can be inserted in the shell in proper position and only thereafter the holding elements and the supporting elements are formed.

In order that the invention and its various other preferred features may be understood more easily, some embodiments thereof will now be described, by way of example only with reference to the drawings, in which:-

Figure 1 is a partial section through a wiper motor housing constructed in accordance with the invention,

Figure 2 is a front view of the motor housing of Figure 1 and,

Figure 3 shows, to an enlarged scale, part of the end cap rim after deformation.

Figure 1 shows a cylindric housing comprising a shell 10 and an end cap 11. The end cap 11 is in known manner punched out from a planar blank and pressed to a shape as is known for wiper motors. In an unstressed condition this end cap 11 has a planar supporting rim 12. The contour of this supporting rim is in accordance with the shape of the inner wall of the shell 10, thus in the present case it is circular. Several supporting elements 13 are indented or cut out of this shell and extend towards the interior. These supporting elements 13 have supporting surfaces 14 which lie in a common plane and against which abuts one side of the supporting rim 12. In the circumferential direction, offset from these supporting elements, holding elements 15 are furthermore indented or cut out of the shell, which holding elements have also supporting surfaces 16 which abut the other side of the supporting rim 12.

For the present invention the axial arrangement of the supporting elements 13 and of the holding elements 15 relative to a plane of reference is essential, for example the plane E defining the front side of the shell 10. The spacing of the supporting surface 14 of the supporting element 13 from this plane of reference E is designated A1 in Figure 1. The spacing of the supporting surface 16 of the holding element 15 from this plane E is designated A2. In the motor housing of British patent No. 1,226,243 the spacing A2 is equal to the spacing A1 minus the sheet metal thickness D of the end cap 11. This means that in this known embodiment the supporting rim 12 remains planar even after the end cap 11 has been fastened on the shell 10. In contrast thereto the spacing A2 of the present invention is greater than the spacing A1 minus the thickness D. This means that the supporting rim 12 cannot remain planar and is deformed to a corrugated contour in the circumferential direction. Thus the supporting rim 12 is prestressed from its original shape. Due to the resilience of the material the supporting rim 12 has the tendency to revert to its unstressed condition, so that forces act upon the holding elements and upon the supporting elements which provide a solid connection free from play between the shell 10

almost uniformly distributed around the circumference of the shell, whereby a holding element is provided approximately midway between two supporting elements. Thus also the stressed end cap rim of Figure 3 shows uniform corrugations. However other arrangements of the holding elements and of the supporting elements can be conceived without departing from the scope of the present invention. In some embodiments it will be in particular considered that magnet segments secured on the shell approach the supporting rim of the end cap as closely as possible. Then no supporting elements should be provided in these angular areas.

The method for a production of a housing of this kind will now be described with reference to Figure 1:

An arbor 20 can be seen which, distributed over its circumference has several open recesses 22 ending in the front face 21. The front face 21 of this arbor 20 deviates from a plane and is shaped in such a way that the supporting rim 12 of the end cap 10 resting against it occupies its final prestressed position. A die 23 with a correspondingly shaped supporting ring 24 presses the end cap 11 against the arbor 20. By means of the arbor 20 and the die 23 the end cap 11 is thus inserted in proper position and prestressed into the shell 10 which has already been bent. Thereafter shearing dies 25 and 26 are radially moved inwards and thereby the supporting elements and the holding elements are cut out of the shell 10. Hereby the bases 22' of the recesses 22 and also the inner face of the end cap 11 serve as shearing edges for the supporting elements 13. The outer face of the end cap 11 serves as a shearing edge for the holding elements. Thus from Figure 1 it results that the end cap rim effectively serves as a forming tool for both the supporting elements and the holding elements. Therefore the supporting elements and the holding elements can be formed simultaneously in the shell 10, so that the method is considerably simplified.

The production of a housing according to the present invention offers advantages in comparison with the prior art: The shell is pressed out of a planar blank, whereby in contrast to the prior art no additional slots or indentations have to be made into this blank. Thus the pressing tool for the shell is considerably simplified.

This blank is then bent or rolled around an arbor. This operation is thus no more time consuming than that of the prior art.

Thereafter the end cap 11 is located in the shell and brought into its prestressed form in proper position by the arbor 20 and the die 23. This operation is again no more expensive than that of the prior art.

Finally the holding elements and the supporting elements are cut as a single operation and thus the housing is completed.

The connection between the end cap and the shell is thereby considerably more stable than that of known embodiments. The reason is that both,



elements can be pressed towards the housing interior so that they form webs, as has been indicated in Figure 2. However, alternatively, pocket-shaped indentations as shown in the German specification OS No. 2,411,622 can also be employed.

The prestress of the end cap 11 is exactly defined by the shape of the front face 21 of the arbor 20 and the corresponding design of the supporting ring 24 of the die 23. This initial tension is also retained when the end cap is mounted, because the end cap rim serves as a shearing edge. It is not overcome either by dynamic operating loads, because the supporting elements and the holding elements are formed transversely to the direction of the force exerted by the supporting rim and therefore there is no risk that these will give way.

By the method described motor housings with a relatively thick shell can be produced economically. Thereby the thickness D of the end cap can be smaller than the thickness of the shell. Due to the intimate connection between end cap and shell the magnetic conductivity and the heat abstraction is furthermore improved, which is very important in the case of efficient motors.

Finally, it is pointed out that in the drawing the means for illustrating the invention are not shown true to scale. In particular the drawings of the various Figures are not shown at the same scale. With the normally used thicknesses of material for motor vehicle wiper motors a prestress V of 0.2 - 0.3 mm will be sufficient, while in Figure 1 this prestress corresponds to approximately the thickness of the end cap.

### 35 CLAIMS

1. A housing for an electric motor or generator comprising a shell and an end cap located in the shell with a supporting rim which in an unstressed condition is planar wherein several supporting elements and also several holding elements, are indented or cut in the shell and extend towards its interior which holding elements are offset in a circumferential direction relative to the supporting elements, and wherein the end cap rests against a supporting surface of the supporting elements with one side of its supporting rim and against the supporting surfaces of the holding elements with the opposite side of the supporting rim, characterised in that the axial spacing (A2) of the supporting surface (16) of at least one holding element (15) from a plane of reference (E), for example the front side of the shell (10), is greater than the spacing (A1) of the supporting surface (14) of the supporting element (13) adjacent to the holding element (15) minus the thickness (D) of the cap from this plane of reference (E) such that the end cap (11) is fixed under prestress between these supporting elements (13) and the holding elements (15).

2. A housing as claimed in claim 1, characterised in that the supporting elements (13) and the holding elements (15) are cut into the shell (10) so that they form webs which extend in the direction of the force

exerted in that the holding elements (15) and the supporting elements (13) are at least substantially uniformly distributed over the circumference of the shell (10) and that each holding element (15) lies preferably in the middle of two supporting elements (13) assigned to it.

4. A housing as claimed in claim 1 or 2, characterised in that the supporting elements (13) are non-uniformly distributed over the circumference of the shell (10) and arranged outside of particular angular areas.

5. A housing for an electric motor or generator substantially as described herein with reference to the drawings.

6. A method of manufacture of a housing as claimed in any one of the preceding claims, characterised in that the end cap (11) is inserted into the shell (10) in its intended position and the outer face of the rim of the end cap (11) serves as a shearing edge for forming the holding elements (15).

7. A method as claimed in claim 6, characterised in that the end cap (11) is held prestressed in its final position in the shell (10) by tools (20, 23).

8. A method as claimed in claim 6 or 7, characterised in that the inner face of the rim of the end cap (11) serves as a shearing edge for forming the supporting elements (13).

9. A method as claimed in any one of claims 6 to 8, characterised in that the shell (10) is pressed out from a blank, bent or rolled about an arbor (20) which arbor has an end face which deviates from a plane and is provided with several recesses distributed around its perimeter and which recesses end in the front face (21), that the end cap (11) is pressed on the front face (21) of this arbor (20) by a die (23), whereby the supporting rim (12) of the end cap (11) is prestressed to conform with the end face of the arbor, in that the supporting elements (13) and the holding elements (15) are cut by shearing dies (25, 26) transversely to the direction of prestress of the end cap (11), whereby the base (22') of the recess (22) in the arbor (20) and the inner rim of the end cap (11) serve as shearing edges for the supporting elements (13) and the outer rim of the end cap (11) as a shearing edge for the holding elements (15).

10. A method as claimed in any one of claims 6 to 9, characterised in that the cutting of the supporting elements (13) and the cutting of the holding elements (15) is carried out simultaneously.

11. A method of manufacturing a housing for an electric motor or generator substantially as described herein with reference to the drawings.